Galaxy Evolution across the Hubble Time
Proceedings IAU Symposium No. 235, 2006
F. Combes & J. Palouš, eds.

doi:10.1017/S1743921306005175

Figure Rotation of Dark Halos in Cold Dark Matter Simulations

S.E. Bryan and C.M. Cress

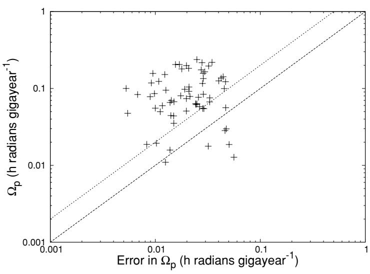
Department of Physics, University of KwaZulu-Natal, Pietermaritzburg, South Africa
email: cressc@ukzn.ac.za

Abstract. We investigate the rotation of dark matter halos identified in ΛCDM simulations. After removing halos that contain a significant amount of substructure, about 82% of the remaining halos were found to undergo coherent rotation over $5h^{-1}$ Gyr. The rotation speeds follow a log-normal distribution. The average rotation speed of a halo was $0.11h$ rads/Gyr. Less than half of the selected halos showed alignment between their rotation and minor axes. We found no correlation between halo properties, such as total mass, and the rotation speed.

Keywords. galaxies: kinematics and dynamics, methods: N-body simulations, dark matter

---

We have simulated the evolution of structure in a $(50\ h^{-1}\ \mathrm{Mpc})^3$ region of space, using the N-body code GADGET (Springel *et al.* (2001)) to evolve 256^3 collisionless particles. Halos are identified from the simulation using a friends-of-friends algorithm. We determine the principal axes of each halo using the inertia tensor and, by following the motion of these axes over several time steps, we measure the figure rotation of halos (Bailin & Steinmetz (2004)). Our results are as follows:



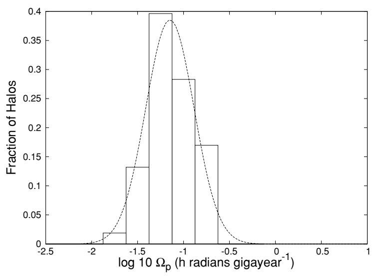


Figure 1. Left: Rotation speeds of halos versus the error in rotation speed. Rotation speed is equal to the estimated error (1 σ limit) at the solid line and twice the error on the dashed line. Right: Distribution of the rotation speeds from our undisturbed halos, fitted with a log-normal distribution ($\mu = -1.14 \pm 0.02$ and $\sigma = 0.26 \pm 0.02$).

The rotation could be relevant for understanding observations of galaxies, such as spiral structure.

Acknowledgements

The financial assistance of the South African National Research Foundation (NRF) towards this research is hereby acknowledged.

References

Bailin, J. & Steinmetz, M. 2004, *ApJ* 616, 27
Springel, V., Yoshida, N. & White, S.D.M 2001, *New Astron.* 6, 79